DOCUMENT RESUME

ED 472 679 IR 021 903

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TITLE	Applications of Technology, Currently Being Used in Business and Industry, to Education.
PUB DATE	2002-11-30
NOTE	17p.
PUB TYPE	Reports - Evaluative (142)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	*Business; Computer Mediated Communication; Computer Networks; *Computer Use; *Computer Uses in Education; Corporations; *Educational Technology; *Information Technology; Virtual Classrooms
IDENTIFIERS	Digital Video Interactive; Handheld Computers; Service Providers; Video Teleconferencing; XML

ABSTRACT

Most educational institutions lag far behind business and industry in the adoption and use of technology. This paper explores the applications of technologies that are currently being used in business and industry, to education. The following technologies are reviewed: virtual learning, wireless networking, collaboration tools, digital video, Application Service Providers (ASPs), handheld devices, videoconferencing, and Extensible Markup Language (XML). (Contains 27 references.) (Author/AEF)

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ED 472 679

APPLICATIONS OF TECHNOLOGY, CURRENTLY BEING USED IN BUSINESS AND INDUSTRY, TO EDUCATION.

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Abstract

Most educational institutions lag far behind business and industry in the adoption and use of technology. The purpose of this paper was to explore applications of technology, currently being used in business and industry, to education. The following technologies were included: virtual learning, wireless networking, collaboration tools, digital video, ASP's, handheld devices, videoconferencing, and XML.

APPLICATIONS OF TECHNOLOGY, CURRENTLY BEING USED IN BUSINESS AND INDUSTRY, TO EDUCATION.

Introduction

The purpose of this paper is to explore applications of technology, currently being used in business and industry, to education. The author of this paper has been involved in education at various levels for twenty-two years. It has been his observation that K-12 education lags far behind business and industry in the adoption and use of technology.

A fascinating topic in many business textbooks concerns the transformation of the business enterprise. If schools are preparing young people to be informed citizens, as well as for the workforce, the students must leave schools properly equipped. This is not the usual case, in terms of today's high school graduate. The bottom line: schools must join the transformation or risk irrelevance.

Virtual Learning

The first technology to be considered is Virtual learning. Virtual learning is revolutionizing the way society thinks about schools. Not many years ago, only face-to-face, i.e., proximate-delivered education was considered as being fully legitimate. Virtual learning was conducted through correspondence courses and was considered academically suspect by many in the educational community. With the advent and expansion of the Internet, this perception has changed to the extent that a new paradigm is being accepted. That paradigm is virtual learning.

The Instructional Telecommunications Council (ITC), a leader in virtual learning education, is a professional organization with the mission to provide leadership, information, and resources to expand and enhance distance learning through the use of technology. The Council defines distance learning as, "the process of extending learning, or delivering instructional resource-sharing opportunities, to locations away from a classroom, building or site, to another classroom, building or site by using video, audio, computer, multimedia communications, or some combination of these with other traditional delivery methods." (http://www.itcnetwork.org/definition.htm). The ITC website provides a list of hyperlinks to statewide virtual learning networks. One link is to the California Virtual campus (CVC), which does not grant degrees or certificates, or answer individual questions about courses. The Website is designed to assist others to find out about courses and certificate or degree programs offered at a distance by California's leading institutions of higher education (http://www.cvc.edu/). Another, Michigan Virtual learning Collaborative, was created as a virtual learning collaborative (VLC) among Michigan's community colleges. The collaborative is designed to allow current Michigan community college students to take courses from other member colleges while still receiving support services and maintaining their academic record at their designated home college (http://www.mccvlc.org/). The ITC website, under continuous construction and revision to maintain currency, offers these, and many others, to virtual learning opportunities. ITC also has a number of corporate members, such as Harcourt e-Learning, NextEd, and Scottish Knowledge.

Wireless Networking

The second technology to be considered is wireless networking. Years ago, schools and districts began to connect classrooms to networks for access to information and teaching enhancements. These networks were costly to install, due to the reconstruction of buildings to accommodate the wires upon which the networks depended. Now, in efforts to keep maintenance and installation costs down, some schools are replacing the wired networks with wireless systems. These wireless networks operate via microwaves, cellular technology, and radio frequency. Soon, these wireless networks will allow for mobile learning environments. The Texas Center for Educational Technology provides extensive tutorials on using wireless networks in school environments. According to the Center,

> As school districts struggle with how to interconnect local area networks (LANs) that they have in operation at various campuses to form a wide area network (WAN), one viable solution that is not well known is the use of wireless technology. Wireless network bridges, using spread spectrum radio waves or microwaves, can be used to connect LANs that are separated by as much as 25 miles. Many of the less powerful bridges, however, may be limited to a range of 2-5 miles.
>
> These wireless links can provide data transfer rates from less than 1 Mbps to more than 10 Mbps. As one might expect, the greater the link distance capability, and the higher the data transfer rate, the more expensive is the equipment. For example, a pair of bridges operating at a radio frequency of 900 MHz may cost $6000, provide a link distance of 1.0-2.0 miles, and transfer data at 1 Mbps.
>
> A 2.4 Ghz bridge might cost approximately $5000, provide a reliable link over a distance of 3-6 miles, and transfer data at 2 Mbps. A microwave link at 31 Ghz may provide a connection over 7-10 miles at 10Mbps (full duplex) for a cost of less than $30000 for the equipment.

> One really attractive feature of wireless connections, and their major advantage, is that there is a one-time cost for the equipment and installation. There are no recurring, on-going monthly costs! Thus, when compared to connection options that have continuing monthly fees associated, the wireless solution quickly pays for itself.
>
> The potential drawbacks to a wireless solution include environmental factors. The terrain may eliminate wireless as an option. Intervening hills and tall buildings or trees can block the radio frequency (RF) signals. Wireless RF technology is referred to as "line-of-sight". This means that the antennas on the wireless bridge units must be able to "see" each other; there must be no obstacles in the way to block or reflect the transmitted signals.
>
> Severe weather, such as torrential rains, can adversely affect signal transmission and temporarily down the link. Similarly, the link might be susceptible to other radio frequency interference. Dense fog could possibly be a problem for microwave links (http://www.tcet.unt.edu/wlan.htm).

Also included on the website are links to information concerning wireless networks in education, as well as many links to vendors providing such products and services.

Collaboration Tools

The third technology to be considered is collaboration tools. The Internet contains an enormous wealth of facts, figures, and information. Yet, in terms of impact on education, its greatest value may be, not in the information on the webpages, rather its ability to connect teachers and learners together in more collaborative ways. For example, teachers can collaborate with other teachers on professional development ideas, via listservs and multi-user domains (MUDs). Also, numerous vendors provide school districts with web presences that enable teachers to extend their courses beyond the four walls and collaborate with others in distant locations, or even nations. The Global

Schoolhouse is an organization that promotes the collaborative use of networks via moderated online collaborative projects for classes, such as field trips and online learning games (www.gsn.org). For teachers desiring their students to collaborate online without teacher interaction, the Landmark Project offers a free software tool whereby teachers can set up WebQuest-style online activities with embedded chat rooms for students to have structured discussions about what is being learned (www.landmark-project.com/slate.html). Other online course environments that engender collaborative learning include Blackboard (www.blackboard.com), Lotus Learning Space (www.lotus.com/home.nsf/welcome/learnspace), and MSN Learning (www.ecs.msn.com).

Digital Video

The fourth technology to be considered is digital video. Until recently, the quality of video over the Internet has been substandard, when compared to the full-motion video of television. This lower quality has served as a barrier to acceptance by educators. This will change with the emergence of Internet2, which provides digital video of high quality, as opposed to streaming video. This, in turn will allow educators and learners to broadcast their own creations to others. Unlike the Internet, Internet2 will allow interactivity, engendering more compelling communication and modalities of instruction. According to the Official Site for Internet2, it is being led by over one-hundred eighty U.S. universities working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of the next generation Internet. Specific initiatives include (http://www.internet2.edu/):

1. Applications. Advanced network applications allow people to collaborate and access information in ways not possible using today's Internet.
2. Middleware. Capabilities such as authentication, authorization and accounting will allow advanced applications to operate seamlessly among many organizations.
3. Advanced networks. National, regional and campus networks provide the end-to-end high performance required by advanced applications.
4. Engineering. Capabilities such as multicasting and quality of service will allow networks to work smarter and more efficiently.
5. Partnerships. Partners in industry, government and other countries are working with Internet2 universities to develop and test the technology of tomorrow's Internet.

The use of digital video in the K-12 environment will be of such quality that it will migrate to traditional broadcast television. For example, another digital video initiative, SchoolHouse Video, is a collaborative project between Southern California educators and KOTC-TV, with the following objectives: (1) empower K-12 students to use cutting-edge technology to create broadcast quality videos; (2) allow K-12 teachers, parents, and administrators a forum in which to share stories about their schools; and (3) provide broadcast quality videos to share with others that communicate quality educational programming via broadcast television (http://www.schoolhousevideo.org/).

Application Service Providers

The fifth technology to be considered is application service providers (ASP"s). Many school districts have followed the business practice of migrating from mainframes to client-server environments. This move has provided schools with access to more feature-rich applications, faster service, and control over local data. With the advent of broadband technology, schools are now looking to ASP's to outsource critical information systems, both educational and administrative. By using ASP's, schools can

reduce the cost of implementing and maintaining applications via subscription-based Internet or network access to off-site administrative and classroom applications. In-class applications might include skill development exercises, age-appropriate productivity tools, and science laboratory simulations. Administrative applications might include achievement-tracking, individual learning plan management, and full-service management information systems for organizing student information and library circulation. A global consortium of leading education technology and service provider companies was founded in 1999, collaborating to promote access to anytime, anywhere learning over the Internet for educational institutions. SchoolTone Alliance is an independent, nonprofit, mutual-benefit association. Membership is fee-based with three participatory levels: principal, associate and affiliate. Members supply the technology infrastructure, content, applications and communication tools necessary to provide educational services via the Internet. Alliance members share a commitment to promoting the benefits of the portal computing model as a way of helping educational institutions accelerate the use of technology and better concentrate scarce resources on improving the learning environment for students - all while reducing overall costs (http://www.schooltone.com/).

Curriculum and productivity ASP's such as Learning Tools International (http://www.ltools.com/) provide comprehensive technology services to support district and statewide IT implementations. Using Industry Standard technologies and state-of-the-art Internet Data Center facilities, confidential student data is protected and can be integrated with existing district information systems (Student SIS, Human Resources, Transportation). Other school administration and communication ASP's include

PowerSchool, a leading web-based student information system (http://www.powerschool.com/) and Chancery, which offers leading-edge technology to manage K-12 student information at the district, school, classroom and community levels (http://www.chancery.com/). Curriculum and productivity software ASP's include Riverdeep, which provides comprehensive K-12 eLearning solutions via comprehensive courseware and supplemental curricula over the Internet and CD-ROM, assessment and management tools, and professional development (http://www.riverdeep.net/), and the similar firm, Learning Station (http://www.learningstation.com/newsite/htm/splash1.htm).

Handheld Devices

The sixth technology to be considered is handheld devices. A number of handheld devices are commercially available for use: personal communications tools (email and chat), e-book readers (specialized devices for e-books), and other well-known products such as Palm OS and Pocket PC's. Many offer wireless networking, which means students have portability and ubiquitous use capabilities.

Numerous vendors are working with educators to bring handheld devices to students, teachers, and administrators. According to the Palm Corporation (http://www.palm.com/education/palmED/),

> Palm handhelds offer simple, quick, fun and smart ways to communicate, teach and learn wherever you go. With a Palm handheld, a teacher, student or administrator can do amazing things: access the Internet wirelessly, take notes, calculate, sketch ideas, collect data, access resources, manage activities and courses and instantly beam information to others.

> Palm's goal is to provide cost-effective tools that streamline educators' work so they can focus on teaching and research. Palm also is committed to helping colleges and schools offer students computing access within their overall curriculum, bringing students closer to an ideal one-on-one experience with technology-based tools.

The Concord Consortium provides information on handhelds via the project ProbeSight, which offers suggestions for integrating handheld devices across the curriculum, such as organizing and planning, reference information, data display and manipulation, data gathering, individual learning, and communication and collaboration (http://www.concord.org/probesight/curriculum/template_section.htm).

Videoconferencing

The seventh technology to be considered is videoconferencing, which utilizes compressed digital video to transmit data between locations via the Internet or ISDN telephone lines. Participants require access to specific equipment, such as cameras, monitors, microphones, and speakers. The ISDN option is better in terms of delivery, but costs more. However, newer systems cost $7,000 dollars as opposed to the $60,000 investment required five years ago (www.polycom.com). Also, as Internet2 is expanded from research institutions to a limited number of K-12 schools,

An excellent example of videoconferencing application to education is offered by the Ocean Institute, which provides videoconferencing programs over both an ISDN-based Zydracron system and a T-1-based RoseTel system. One of the programs allows students in distant locations to receive real-time answers to questions and close-up "looks" at sea creatures as marine biologists examine tide pools in Southern California (http://www.ocean-institute.org/). Videoconferencing also allows collaboration with

international colleagues. International videoconferencing adventures for schools are gaining popularity. One example, Yabbies Online, displays the following abstrat:

> Matthew grins broadly as he introduces the biggest Yabbie (Australian freshwater crustacean) I have ever seen. Yoko displays her grandmother's Kimono with respect and reverence. This is show and tell with a difference and at a cost, but East Meets West and Lab's Alive are projects providing unique collaborative learning experiences through integrated technologies. We are providing students with opportunities to become more aware of the social and political world and to gain the necessary skills to interact as global citizens. Project participants are treading new educational boundaries. Along with our partner schools, we are still in the process of trial and error, but fast exploring some of the exciting international potential of videoconferencing technology. In many ways these sessions are providing educational value for the money. With more of our teachers involved in local curriculum delivery through this medium, the skill base will add dimension to our already excellent global classroom project work. (http://www.techlearning.com/db_area/archives/WCE/archives/jotatel.html).

The future of videoconferencing may include tele-immersion 3-D, which are virtual reality environments where participants communicate with each other in the same room.

Extensible Markup Language (XML)

The final technology under consideration is XML, "a general purpose language that describes the structure of a document and supports links to multiple documents, allowing data to be manipulated by the computer. Used for both Web and non-Web applications (Laudon, 2002)." This web-development tool will drastically change how schools and computers share information. Content coded with XML tags are shared among applications, resulting in the need for data to be entered only once in the system. For example, suppose a data on a student is entered into the district student information

system (SIS). That data can be distributed via XML messages to other units such as the library, cafeteria, and transportation, without the need for data reentry in each unit.

The IMS Global Learning Consortium is dedicated to "developing and promoting open specifications for facilitating online distributed learning activities such as locating and using educational content, tracking learner progress, reporting learner performance, and exchanging student records between administrative systems (http://www.imsproject.org). " This includes efforts to create XML-based specifications to facilitate the online distribution of content and student data.

Another XML initiative is offered by The Schools Interoperability Framework (SIF). SIF is an industry initiative to develop an open specification for ensuring that K-12 instructional and administrative software applications work together more effectively. SIF is not a product, but rather an industry-supported technical blueprint for K-12 software that will enable diverse applications to interact and share data seamlessly; now and in the future. SIF promotes (http://www.sifinfo.org/):

> A standard set of specifications used by all education software companies would:
>
> 1. Ensure that data is entered only once in one application, and automatically propagates to other applications
> 2. Allow applications to exchange data more effectively
> 3. Enable schools to create powerful reports by accessing data from different applications
> 4. Allow educators to deliver reports securely via the Internet to various organization

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